Subclinical disease: Its impact and detection

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Introduction

• Subclinical disease:
  – An infection present, but displaying no clinical signs

• Disease within a herd can be present
  – Clinically
  – Purely sub-clinical

• Difficult to detect on farm
  – Makes treatment and control more challenging
  – Under-reporting of disease
  – Risk of disease spread
Disease within the finisher herd

- Reduces the efficiency of production
- Reduces growth rate
- Reduces feed efficiency
- Poorer carcase characteristics

Costs £

- Increases variability
- Increases days to slaughter
- Increases costs of production

Efficiency
The response of the immune system

**Innate immune system**

- Quick, non-specific response
- Macrophages, neutrophils & natural killer cells
- Cytokines
- Acute phase proteins

**Adaptive immune system**

- Slow, highly specific response
- Lymphocytes – T & B cells
- Long lasting protection confirmed
- Vaccination uses adaptive system.
Why disease hits profits: the biological process

Pig encounters pathogen challenge on farm

Activation of the innate immune response

Cytokines released by defence orientated cells

Nutrients diverted away from growth
- Fight infection

Central nervous system

Feed & water intake
- Locomotor activity
- Listless
- Fever
The true extent of effects............

• Herd specific
  – Immune status of the herd
  – Level of challenge presented
  – Efficiency of vaccination policy

• Growth rate reductions during clinical disease:
  – 22% reduction – scour (Seddon, unpublished PhD thesis)
  – 30% reduction - Ileitis (Malachy et al., 2011)
  – 50% reduction – active pneumonia (Seddon, unpublished PhD thesis)
Performance change from sub-clinical infection

Fig 1. Difference in feed conversion ratio & average daily gain from sub-clinical ileitis from three separate trials
(Paradis et al., 2005)
Symptoms of sub-clinical disease on farm

• Unthrifty pigs

• Greater variation
  – In body weight
  – In growth performance
  – How many pigs reaching the ‘optimum box’?

• Sub-optimal growth performance

• Change in carcase characteristics

• Monitoring required to really know
  – How badly affected?
  – Where does the problem begin to start?
Variation from disease

• Variation is natural & will always be there

• Farms with health problems show increased variability
  – Individual susceptibility of pigs to disease

• Recognise when variation is too great

• But don’t recognise too late!
Measuring variation

- Mean weights – provide no measure of variation

- Standard deviation (SD) measures dispersion
  - Greater variation in pigs – larger S.D.

- Coefficient of variation (CV) – the SD expressed as a percentage of the mean

- CV can use as a guide of relative variation within a group as pigs grow
Distribution of weight – 20 weeks of age

N = 632; Mean = 103.7 kg; SD = 8.3 kg

Fig. 2 Distribution of pig weights at 20 weeks of age (Patience et al. 2003)
<table>
<thead>
<tr>
<th>Measurement on farm - 1</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Average Age (days)</th>
<th>19 (Wean)</th>
<th>68 (Nursery exit)</th>
<th>140 (First Pull)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of pigs</td>
<td>1,264</td>
<td>700</td>
<td>632</td>
</tr>
<tr>
<td>Mean (kg)</td>
<td>5.4</td>
<td>29.1</td>
<td>103.7</td>
</tr>
<tr>
<td>Minimum (kg)</td>
<td>2.4</td>
<td>23.8</td>
<td>74.4</td>
</tr>
<tr>
<td>Maximum (kg)</td>
<td>9.2</td>
<td>40.9</td>
<td>124.9</td>
</tr>
<tr>
<td>Range (kg)</td>
<td>6.8</td>
<td>17.1</td>
<td>50.5</td>
</tr>
<tr>
<td>Range (% of mean)</td>
<td>121</td>
<td>59</td>
<td>48</td>
</tr>
<tr>
<td>SD (kg)</td>
<td>1.2</td>
<td>3.7</td>
<td>8.3</td>
</tr>
<tr>
<td>CV (%)</td>
<td>22</td>
<td>13</td>
<td>8</td>
</tr>
</tbody>
</table>

(Patience et al., 2003)
Guideline

• Determine when variation needs to be **reduced**

• Determine when variation needs to be **managed**

**A reasonable target:**

- Weaning weight: CV = 20%
- Nursery exit weight: CV = 12 to 15%
- Finisher first pull: CV = 10 to 12%

(Patience et al., 2004)

• Farms with disease - CV observed as high as **31%**

(Dewey et al., 2001)
### Measurement on farm - 2

<table>
<thead>
<tr>
<th></th>
<th>Birth</th>
<th>Wean</th>
<th>Grower</th>
<th>Finisher</th>
<th>Slaughter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number pigs</td>
<td>714</td>
<td>714</td>
<td>712</td>
<td>692</td>
<td>658</td>
</tr>
<tr>
<td>Average age (days)</td>
<td>0</td>
<td>27.4</td>
<td>74.7</td>
<td>114.1</td>
<td>154.4</td>
</tr>
<tr>
<td>Minimum</td>
<td>0.55</td>
<td>1.86</td>
<td>10.60</td>
<td>27.90</td>
<td>53.40</td>
</tr>
<tr>
<td>Mean</td>
<td>1.56</td>
<td>7.57</td>
<td>29.51</td>
<td>56.7</td>
<td>83.72</td>
</tr>
<tr>
<td>Medium</td>
<td>1.58</td>
<td>7.60</td>
<td>29.80</td>
<td>57.20</td>
<td>82.60</td>
</tr>
<tr>
<td>Maximum</td>
<td>2.52</td>
<td>12.61</td>
<td>50.80</td>
<td>84.00</td>
<td>126.10</td>
</tr>
<tr>
<td>Range</td>
<td>1.97</td>
<td>10.75</td>
<td>40.20</td>
<td>56.10</td>
<td>72.70</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.34</td>
<td>1.77</td>
<td>6.33</td>
<td>9.16</td>
<td>11.40</td>
</tr>
<tr>
<td>Coefficient of variation (%)</td>
<td>22.05</td>
<td>23.32</td>
<td>21.45</td>
<td>16.14</td>
<td>13.60</td>
</tr>
</tbody>
</table>

Range in weights-sub-clinical PCV2

Fig. 3 Distribution of weights of commercial finisher pigs, vaccinated for PCV2 and controls (Malachy et al., 2011)
Importance of weighing recognised

www.pigscale.com
Health scores to aid clinical health observations

• Observing patterns in clinical symptoms
  - Clinical symptoms occurred, sub-clinical disease preceded
• Health scores performed each week
  – Simple, consistent, build recognition of a problem

Health scores monitored from pen groups in grower and finisher stages on one farm
Health scores

• Could be utilised in conjunction with:
  - Measures of growth rate of pigs (batches or pen groups)

• Correlations found between cough scores and:
  – Pneumonia in live pigs \( P < 0.001 \)
  – Lung lesions at slaughter \( P < 0.05 \)

• Abattoir health scores – BPHS
  - Link to where in herd coughing observed
Monitoring water consumption to assist health management

- 24 pens finisher pigs monitored
- Water consumption via water pulse meters
- Daily measures used – simpler level
Factors associated with daily water use

<table>
<thead>
<tr>
<th>Predictors</th>
<th>Replicates 1 &amp; 2 (N=24 pens)</th>
<th>Rep. 2 only¥ (N=12 pens)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R² (adj)</td>
<td>31.7%</td>
<td>43.8%</td>
</tr>
<tr>
<td>Pig weight</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td>No. Pigs</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td>Daily live weight gain</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td>Drinker type</td>
<td>***</td>
<td>NS</td>
</tr>
<tr>
<td>Ext. min. temp.</td>
<td>***</td>
<td>NS</td>
</tr>
<tr>
<td>Ext. max. temp.</td>
<td>***</td>
<td>NS</td>
</tr>
<tr>
<td>Room max. temp</td>
<td>NS</td>
<td>*</td>
</tr>
<tr>
<td>FCR</td>
<td>-</td>
<td>*</td>
</tr>
</tbody>
</table>

Where asterisk occur: *** = $P < 0.001$, ** = $P < 0.01$, * = $P < 0.05$. (Positive, Negative)

¥ = replicate two only included measurement of feed intake.
Water intake & health

Fig. 1 Daily water use per pig in relation to severity of scour score observed in that week, all NS

Fig. 2 Daily water use per pig in the preceding week relation to severity of scour score observed in different trial weeks. $T = P = 0.067$
Acute Phase Proteins in Oral Fluid for the assessment of sub-clinical disease

- Paired serum and oral fluid from 80 pigs
  - differing ages, heavy and light groups
- Pooled oral fluid sample per pen

- Growth
- FCR
- Weekly health scores
- Haptoglobin
- C-reactive protein
- PRRSv
Results – individual pig level

80 Individual pigs sampled

• Sub-optimal gain/day: 0.65kg

• Poor FCR: 3.31

• Few clinical signs

• PRRSV
  - OF negative
  - Serum 94% seroconverted

• Individual pig serum and OF APPs: positive but weak correlations

  - Hp ($r = 0.297, \ P < 0.01$)
  - CRP ($r = 0.305, \ P < 0.05$)
Acute Phase Protein Results

Finisher gain per day
OF CRP
(P <0.0001)

Daily Gain

Lifetime daily gain
OF Hp
(P <0.0001)

Days in finisher

Pooled pen sample
OF CRP

OF CRP
OF Hp
(P <0.0001)

Daily Gain
Oral fluid diagnostics

• Pooled sample lowers cost

• Facilitates regular disease surveillance

• Complex interactive effects of disease circulation (Ramierz et al., 2012)

• Further research required

• Work is making progress
Fig. 3 Presence of porcine circovirus type 2 (PCV2), Torque teno virus genogroups 1 and 2 (TTV1, TTV2), porcine reproductive and respiratory syndrome virus (PRRSV), and influenza A virus (IAV) in barns over time. (Ramirez et al., 2012)
Conclusions & Applications

• Sub-clinical disease aware
  – Understanding where and the degree of loss
  – Target management, reduce extent of loss
• Weighing pigs - determine performance loss
  – Weights from range of individuals

• C.V. is an effective management tool to determine if variation is excessive on a farm

• Consider performance with health observations
  – Health scores – consistent, once per week
  – British Pig Health Scheme results
Conclusions & Applications

• Water monitoring a powerful tool for management
  – A lead indicator of changes
  – Health, performance & environment
  – Simple, daily consumption measures useful

• Relationships between daily gain and Acute Phase Proteins
  - A powerful tool to assess reduced production related to immune activation
  - Benchmark herds against one another

• Relationships in oral fluid
  – Lower cost methods
  – Pooled sample – drastically reduced costs
BPEX Health Improvement Project

• Producers, vets and industry – working together
  – Collectively benefiting the English pig industry!
• FREE BPHS abattoir reports
• Local health mapping
• Tailored biosecurity action plan
• Disease testing
• Regional support

Sign up today!
BPEX Health Improvement Project

- Regional cluster meetings currently taking place

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Thankyou